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Alfalfa silages and hay and corn supplementation for yearling steers

Abstract

Four alfalfa forages were evaluated: 1) hay; 2) low-dry matter (DM) silage; 3) medium-DM silage; and 4) high-DM silage. All forages were full-fed along with 2 lb of supplement or supplement plus 2 or 4 lb of cracked corn. Calves fed hay or medium-DM silage had the fastest and most efficient gains. Hay had the highest intake; low-DM silage, the lowest. Adding corn to the ration improved calf performance slightly, but feed costs per lb of gain were similar for all three levels of corn supplementation. Low- and medium-DM silages were better preserved than high-DM silage, which contained considerable spoilage due to yeasts and molds. High-DM silage also had the highest ensiling temperatures and it was slightly less stable in air on feedout than was either of the other two silages. Dry matter recovery from the stave silos, however, was about 3 percentage units greater for the high-DM silage than for the low- or medium-DM silages.

Keywords

Cattlemen's Day, 1982; Report of progress (Kansas State University. Agricultural Experiment Station); 413; Beef; Alfalfa silages; Hay; Corn; Steers; Dry matter

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Alfalfa Silages and Hay and Corn Supplementation for Yearling Steers

Keith Bolsen, Harvey Ilg, Mark Hinds, and Jim Hoover

Summary

Four alfalfa forages were evaluated: 1) hay; 2) low-dry matter (DM) silage; 3) medium-DM silage; and 4) high-DM silage. All forages were full-fed along with 2 lb of supplement or supplement plus 2 or 4 lb of cracked corn. Calves fed hay or medium-DM silage had the fastest and most efficient gains. Hay had the highest intake; low-DM silage, the lowest. Adding corn to the ration improved calf performance slightly, but feed costs per lb of gain were similar for all three levels of corn supplementation.

Low- and medium-DM silages were better preserved than high-DM silage, which contained considerable spoilage due to yeasts and molds. High-DM silage also had the highest ensiling temperatures and it was slightly less stable in air on feedout than was either of the other two silages. Dry matter recovery from the stave silos, however, was about 3 percentage units greater for the high-DM silage than for the low- or medium-DM silages.

Introduction

In our previous trials, we found properly managed alfalfa silage or haylage to be economical and efficient sources of nutrients for growing calves. Adding corn grain to alfalfa rations can greatly improve cattle performance. But how does ensiling alfalfa that is exceedingly wet or exceedingly dry affect its quality? And what level of corn is best with alfalfa? In this trial we compared well-made alfalfa silage with hay and poorly-made silages and evaluated three levels of corn supplementation for growing calves.

Experimental Procedures

In May, 1981, first-cutting alfalfa was obtained from a single field when at 1/10 to 1/4 bloom. The four harvest treatments were: 1) low-dry matter (DM) silage; 2) medium-DM silage; 3) high-DM silage; and 4) field-dried hay. After the alfalfa had been swathed with a mower-conditioner on May 6, low-DM silage was harvested after approximately 1 hr of field wilting; medium-DM silage after 3 to 5 hr of wilting; and high-DM silage after 24 to 30 hr of wilting. Hay was baled into 60 to 80 lb bales on May 11, after the swaths had received about 1.0 inch of rainfall on May 8. Windrows were turned once before baling.

Dry matter of the 12 loads of alfalfa (four loads/silo) is shown in Table 6.1. Low-DM material contained less moisture than expected, probably because of the unusually warm, dry weather several days before harvest and because of slight infestation of alfalfa weevil which resulted in some loss of lower leaves.

Dry matter losses during fermentation, storage, and feedout were measured for the three alfalfa silages by weighing and sampling all loads of material before it was ensiled in concrete stave silos (10 ft x 50 ft) and later weighing and sampling all silage removed. Ensiling temperatures during the first 7 weeks were monitored with six thermocouples evenly spaced in each silo.

About 500 lb of fresh material was removed from each silo during filling and tightly packed into nylon bags (20 to 25 lb/bag) and plastic containers (20 to 25 lb/container). Experimental silo details appear on page 7 of this Progress Report.

Silos were opened after 90 days and silages and hay were each full-fed to 12 Hereford steers averaging 748 lb. All steers received 2 lb of supplement[1] daily; four steers fed each alfalfa also received 2 lb of cracked shelled corn and four received 4 lb of corn. Rations were fed twice daily; the silage and concentrates mixed in the feed bunk. Steers were housed in individual pens for the 49-day trial (August 6 to September 24, 1981).

All steers were weighed individually after 16 hr without feed or water on two consecutive days at the start and again at the end of the trial. Two days before the final weighings, all steers were fed the same amount of feed (14 lb of ration dry matter). An intermediate weight was taken before the a.m. feeding on day 28.

Aerobic stability (bunk life) of each silage was measured as described on page 7 of this Progress Report.

Results

Ensiling temperatures are shown in Figure 6.1. All silages had rather low temperatures for the first 2 weeks. During the next 5 weeks, the low- and medium-DM silages stayed between 25 and 28 C; however, temperature of the high-DM silage increased gradually and reached a maximum of 43 C at 43 days.

Chemical analyses are presented in Table 6.2. Low- and medium-DM silages were better preserved than was high-DM silage, which was dark brown and contained considerable spoilage due to yeasts and molds. In the low- and medium-DM treatments, fermentations were extensive and produced silages that were high in lactic, acetic, and total acids. The high-DM treatment had undergone a minimum fermentation as evidenced by its high pH (5.05) and low total acids (3.69%). In all three silages, the very low butyric acid and NH_3-N levels confirmed the absence of any clostridial fermentation.

Performance of steers for the four alfalfa and three corn treatments is shown in Table 6.3. None of the numerical differences in performance were statistically significant, and there were no interactions between the alfalfa forage treatments and cracked corn additions.

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[1]Lbs./ton of supplement: rolled milo, 1789.7; salt 90;trace minerals, 10; monosodium phosphate, 107; and Rumensin-60, 3.3.

Hay and medium-DM silage gave faster gains (13.7 and 15.3%, respectively) and more efficient gains (8.0 and 10.5%, respectively) than low-DM silage. Steers fed high-DM silage had intermediate rate and efficiency of gains. Hay was consumed in the greatest amount; low-DM silage in the least.

Adding cracked corn to the alfalfa rations improved steer performance only slightly. The extra gain from 1.75 lb of cracked corn dry matter added to the ration was .13 lb; from 3.5 lb of corn dry matter, .19 lb. Adding corn, however, resulted in less alfalfa being consumed by the steers --- 1.59 lb less with the 1.75 lb of corn and 2.82 lb less with the 3.5 lb of corn. At today's feed prices, the feed cost per lb of gain was nearly the same for the three levels of corn supplementation.

The response to corn was less than expected in that results of our previous trial with alfalfa silage showed .37 lb of extra gain from 1.75 lb of corn dry matter added to the ration. Reasons for the differences between trials are not apparent; however, steers fed in last year's trial had a 140 lb lighter initial weight, and in both trials steers were being fed excess protein. The lighter steers, which had a higher protein requirement, were able to use the extra protein (from alfalfa) and energy (from corn) more efficiently.

Presented in Table .4 are silage dry matter recoveries from the concrete stave and experimental silos. In the stave silos, about 3 percentage units more dry matter was fed from the high-DM silage than from the low- or medium-DM silages. This, along with results of silage chemical analyses, indicated that the high-DM silage underwent a less extensive fermentation than did either of the two other silages. Nearly twice as much of the high-DM silage, however, was discarded as non-feedable spoilage when the silos were opened, probably because its compaction was poorer than that of low- or medium-DM silages.

For each of the three silages, losses from the buried bags and 5-gallon containers were only 58 and 42%, respectively, of the losses from the concrete stave silos. These results agreed with those of several of our trials and indicated that losses from the bags and containers were about half the losses from the concrete stave silos.

All three alfalfa silages were highly stable in air on feedout (Table .5). High-DM silage heated on the 10th and 11th days; low- and medium-DM silages showed no signs of spoilage during the entire 14 days of air exposure.

Table 6.1. Dry matter content of the alfalfa at ensiling.

Load number	Silage dry matter treatment		
	Low	Medium	High
	Dry matter, %		
1	28.4	35.6	54.3
2	31.3	37.0	56.4
3	30.2	37.1	54.6
4	32.2	36.2	58.2
Avg. dry matter*	30.5	36.5	56.0

*Weighted averages that are adjusted for diferences in load size.

Table 6.2. Chemical analyses of the four alfalfa forages fed in the steer trial.[1]

Item	Silage			
	Low-DM	Medium-DM	High-DM	Hay
Dry matter, %	29.7	34.5	56.0	92.1
pH	4.23	4.30	5.05	--
	% of the dry matter			
Lactic acid	9.59	8.09	1.65	--
Acetic acid	4.79	4.40	1.92	--
Propionic acid	.30	.19	.06	--
Butyric acid	.01	.06	.01	--
Total fermentation acids	14.83	12.80	3.69	--
Crude protein	20.3	20.0	20.2	19.8
	% of the total nitrogen			
Hot-water insoluble-N	33.4	34.3	41.5	76.3
NH_3-N	7.9	6.8	5.9	--

[1]Each value is the mean of five samples.

Table 6.3.Performance by steers fed each of the four alfalfa and three corn treatments.

	Alfalfa hay	Alfalfa silage			Corn (lb/day)		
		Low	Medium	High	0	2	4
No. of steers	12	12	12	12	16	16	16
Initial wt., lb	749	749	748	747	750	748	747
Final wt., lb	822	813	822	817	815	820	821
Avg. daily gain, lb	1.49	1.31	1.51	1.43	1.33	1.46	1.52
Avg. daily feed, lb[1]							
alfalfa	14.53	13.60	14.34	14.01	15.59	14.00	12.77
supplement	1.80	1.80	1.80	1.80	1.80	1.80	1.80
corn	1.75	1.75	1.75	1.75	--	1.75	3.50
total	18.08	17.15	17.89	17.56	17.39	17.55	18.07
Feed/lb of gain[1]	12.56	13.65	12.21	12.78	13.57	12.69	12.14

[1]100% dry matter basis.

Table 6.4. Alfalfa silage fermentation, storage, spoilage, and feedout losses from the concrete stave and experimental silos.

Silo and silage DM treatments	DM recovered		DM lost during fermentation, storage and feedout
	Feedable	Non-feedable (spoilage)	
	% of the DM put into the silo		
Concrete staves			
low	85.54	2.57	11.89
medium	85.17	3.34	11.49
high	88.31	5.56	6.13
Buried bags[1]			
low	94.08	--	5.92
medium	93.75	--	6.25
high	95.77	--	4.23
5-gallon containers[2]			
low	94.81	--	5.19
medium	95.42	--	4.58
high	97.32	--	2.68

[1]Each value is the mean of six buried bags.

[2]Each value is the mean of six containers.

Table 6.5. Changes in alfalfa silage temperature and losses of dry matter during air exposure.

Silage	Day of initial rise above ambient temp.*	Maximum temp.	Accumulated temp. above ambient, °C		Loss of dry matter (% of DM exposed to air)	
			day 7	day 14	day 7	day 14
		°C				
Low DM	**	**	**	**	<1.0	<1.0
Medium DM	**	**	**	**	<1.0	<1.0
High DM	10.9	40	**	35.7	<1.0	4.1

*1.5 C rise or higher.

**No rise in temperature.

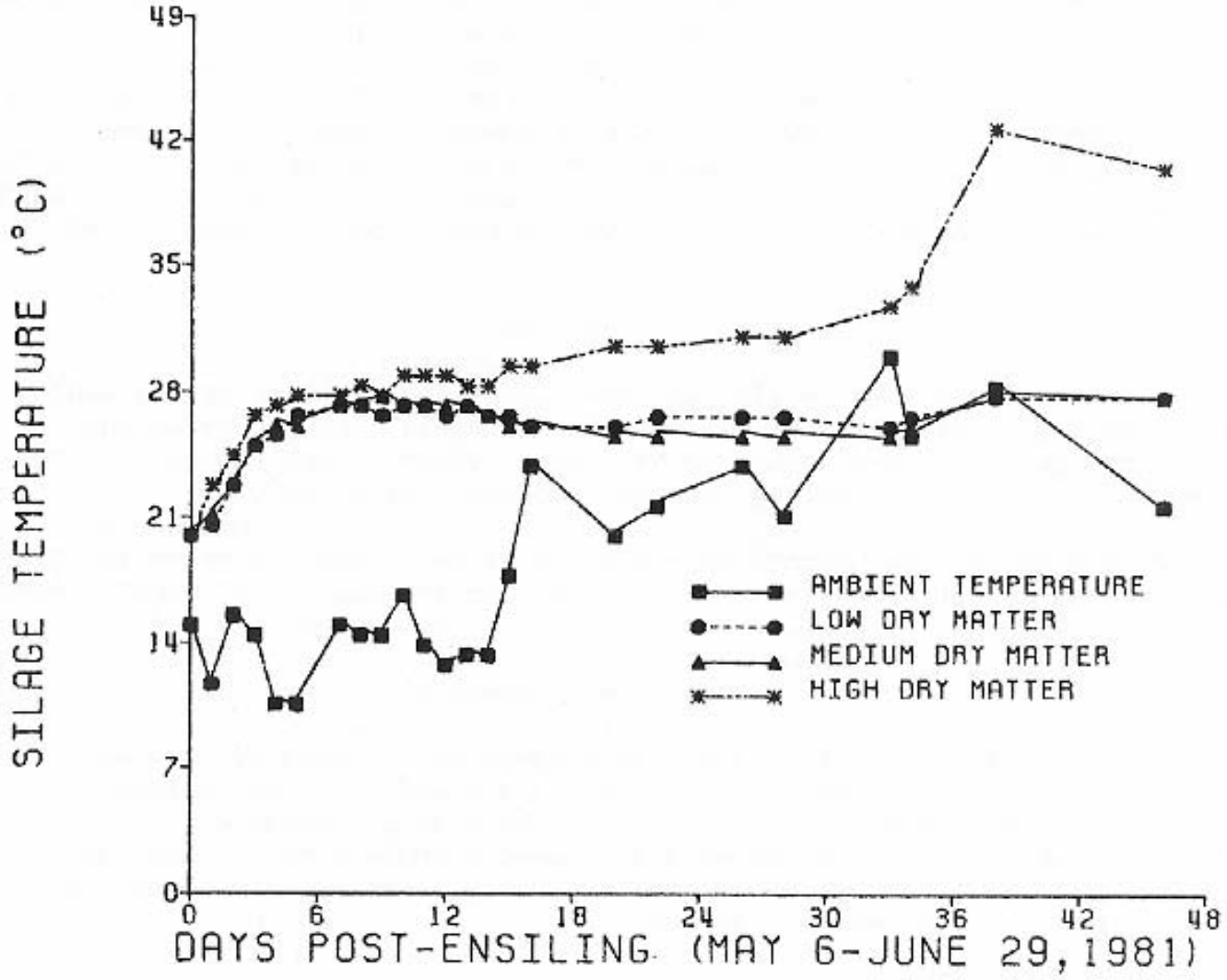

Figure 6.1. Ensiling temperatures for three alfalfa silages.